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2013-09-01

Maki , U 2013 , ' Scientific Imperialism : Difficulties in Definition, Identification, and Assessment ' , International Studies in the Philosophy of Science , vol. 27 , no. 3 , pp. 325-339 . https://doi.org/10.1080/02698595.2013.825496

http://hdl.handle.net/10138/232395
https://doi.org/10.1080/02698595.2013.825496

acceptedVersion

DISCUSSION NOTE

Scientific Imperialism: Difficulties in Definition, Identification, and Assessment

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Forthcoming in *International Studies in the Philosophy of Science*

Abstract

The paper identifies and analyses issues related to defining and evaluating so-called scientific imperialism. It discusses John Dupré's account, suggesting it is overly conservative and does not offer a definition of scientific imperialism in not presenting it as a phenomenon of interdisciplinarity. It then discusses the recent account by Steve Clarke and Adrian Walsh, taking issue with ideas such as illegitimate occupation, counterfactual progress, and culturally significant values A more comprehensive and refined framework of my own is then summarized. It suggests types and aspects of scientific imperialism as a dynamic interdisciplinary relationship, distinguishing between imperialism of scope, style and standing, for example. It also suggests normative (ontological, epistemological, axiological and institutional) constraints on scientific imperialism. This enables to distinguish, in principle, recommendable from non-recommendable kinds of it, while recognizing the difficulties involved in trying to do this in practice.

1. Introduction

'Imperialism' is a term sometimes used for characterizing certain kinds of interdisciplinary relations in science. So we have physics imperialism, economics imperialism, and sometimes even sociology imperialism (but curiously, we usually don't hear much talk about evolutionary imperialism, and even less about computational imperialism, neuroscientific imperialism, social constructivist imperialism, feminist imperialism, etc.). There has been relatively little philosophical writing on this phrase and the phenomenon it names, but the situation is now changing.

A philosophical account of 'scientific imperialism' should provide tools for defining the concept of it, for (descriptively) identifying cases of it, and for (normatively) evaluating it. As we will see, the task is not easy. This is not helped by the fact that

'scientific imperialism' has strong metaphorical connotations. One option would be to dispense with the term altogether and to conceptualize the relevant phenomena in some other terms. Given that the expression is already in use among practicing scientists, another option is to keep it and to explore whether some reasonable philosophical illumination can be given to it, answering the challenges of definition, identification, and evaluation.

Steven Clarke's and Adrian Walsh's recent article in this journal is rather rich in just these respects: it defines and describes scientific imperialism, and it also normatively explores 'the proper relations between the sciences' while also reflecting on the metaphoricality of 'imperialism' (Clarke and Walsh 2009). Their main target consists of a couple of publications by John Dupré in which Dupré both defines and denounces scientific imperialism (Dupré 1994, 2001).

I will first briefly examine the accounts and arguments put forth by Dupré and those by Clarke and Walsh. I will then outline and adjust my own account (e.g. Mäki 2002a, 2009, 2012; Mäki and Marchionni 2011), showing how it might remedy some of the shortcomings of the other two.

2. Dupré's Account

John Dupré is annoyed by two instances of what he terms scientific imperialism: evolutionary psychology and economics applied beyond its traditional boundaries. In arguing against these instances, he also attempts to offer a general account of scientific imperialism. But it turns out that he does not seem to talk about scientific imperialism as a relationship between scientific disciplines.

There are variations of Dupré's general characterization, such as this one: 'By scientific imperialism, I mean the tendency for a *successful* scientific idea to be applied far beyond its original home, and generally with decreasing *success* the more its application is expanded.' (Dupré 2001, 16; emphasis added). An immediate observation about this version is that putting the definition in terms of *success* is ambiguous between very different kinds of success, including mere rhetorical and social success of an idea measured in terms of numbers of adherents. Now it is obvious that for the purpose of characterising and assessing scientific imperialism we need different notions of success, but we need to spell them out and keep them separate.

There are other versions that employ an epistemic notion of scientific performance, such as the one in terms of (still admittedly rather vague) 'illumination' that could be taken as a name for some sort *explanatory performance*, for example. Here is such a definition of 'scientific imperialism': 'By this I mean the tendency to push a good scientific idea far beyond the domain in which it was originally introduced, and often far

beyond the domain in which it can provide much illumination.' (Dupré 2001, 74). As an example, Dupré cites Dennett's notion of 'Darwin's dangerous idea', namely that of 'promising to unite and explain just about everything in one magnificent vision' (Dennett 1995, 82).

There are two ideas here, one descriptive, the other evaluative (the key words are in italics):

[1] Scientific imperialism is:

> [a] the tendency to push a *good* scientific idea *beyond* the domain in which it was *originally* introduced; and
>
> [b] the tendency to push a scientific idea *often far beyond* the domain in which it can provide much *illumination*.

So a scientific idea was originally introduced to deal with domain D1, and it turns out to be a good idea in that it provides illumination to that domain. The idea is then pushed 'far beyond' the original domain, to domains D2, D3, …, but the idea then 'often' loses its capacity to provide illumination and thereby becomes a bad idea in relation to these latter domains. I have a number of comments on this, hoping they will be useful in advancing the discussions.

First, the definition is *silent about imperialism*. There is nothing imperialistic per se in applying a scientific idea *beyond its original domain* of application. Formulation [1ab] says nothing about *what is imperializing* and *what is being imperialized* by such a move. In particular, it is quiet about the institutional side of the matter as it does not mention the role of established disciplines in claiming or occupying the domains that the imperializing discipline enters. So the immediate conclusion is that regardless of what Dupré's intentions were, the definition does not give us a concept of scientific imperialism as a special kind of interdisciplinary relationship.

Second, pushing an idea 'far beyond' its original domain suggests a long distance between domains. But how long is long? What is the metric? How does one measure the distance? In particular, can the distance always be measured independently of the theories or explanatory principles that are being applied? Apple trees on Earth and some distant galaxies are indeed far away from one another measured in terms of kilometres. But the principles of Newtonian mechanism apply to both domains—provide illumination on them. So from the point of view of those principles themselves, there is no big distance between them at all. The two domains obey the same laws, so are of the same kind. Now if we were to take this—the extent to which the same principles apply, or illumination is provided—to measure the distance between the domains, then judgements of type [1b] become tautological: failure to illuminate becomes part of the definition of imperialism.

Third, [1b] suggests that imperialistic expansion *often* leads to explanatory *failure*. I don't think this sort of empirical evaluative element – the idea of frequent failure -- should be part of a general characterization of scientific imperialism. Empirically, it is likely that sometimes the expansion to new far-away domains is, and sometimes it is not, explanatorily successful. That it 'often' isn't, should not be included in the definition of the very concept. Imperialistic expansion should not emerge as a likely failure by definition. Moreover, explanatory failure can, and does, occur on the home grounds of a discipline, so there is no intrinsic necessary connection between failure and adventurous expansion.

Fourth, taking a stance *against* scientific imperialism (Dupré 1994) would appear to mean a radical recommendation for extreme scientific caution. This indeed seems to propose staying on the safe home grounds where a theory was originally introduced. This would imply the advice to avoid taking epistemic risks involved in interdisciplinary trespassing. The implied rule says that if certain kinds of moves in scientific inquiry—namely applying a scientific idea to far-away domains—often fail, they should not be attempted at all. Such a rule would be strongly against the ethos of scientific inquiry—one of risk-taking intellectual adventure. I am sure Dupré does not endorse such implications.

Fifth, [1ab] talks about a 'good' scientific idea being applied beyond its original domain and thereby becoming bad (good –> bad). This seems unnecessarily restrictive. One of Dupré's examples of an imperialistic discipline, conventional economics, is a case in point: many critics of economics imperialism (controversially) argue that economics seeks to imperialistically impose ideas that are bad also in their original domain (bad –> bad). This sequence should not be ruled out by definition.

Sixth, there is another complaint about restricting the definition to originally 'good' ideas. It is conceivable that an idea that is 'bad' in its original domain is applied beyond that domain, but this alone suggests nothing about whether the idea is good or bad in relation to some other distant domain. An originally bad idea may turn out to be an excellent idea when applied to a new distant domain (bad –> good).

In addition to defining what scientific imperialism is, Dupré also hints at an explanation for why it fails, thereby supporting his normative judgement that it is not recommendable. The idea is that imperialistic science fails to secure a link between the idealizations of its models and the claims made about real phenomena (Dupré 2001, 134–135). It is not clear why exactly this would provide sufficient grounds for resisting explanatory expansionism. Science can fail, and actually fails, in all sorts of domains regardless of their distance from the 'original' one (cf. Clarke and Walsh 2009, 198). Theories fail in their original home grounds, and they fail in other domains. And many of these failures are due to a poor contact between idealized models and messy reality. To

have a more reasonable argument, an obvious amendment is to incorporate a principle concerning likelihoods: *the likelihood of failure grows with distance from the original domain.* Provided this is construed in a non-tautological fashion, it might indeed be descriptively correct, but would it suffice as a justification for a normative proscription against scientific imperialism? No, it wouldn't—because it would advise against risky intellectual endeavours.

It may be that evolutionary psychology and Gary Becker's economics of the family—Dupré's prime examples of scientific imperialism—are bad science. But it is not at all clear that they are bad simply because they are examples of interdisciplinary trespassing. Rather, they would be bad for the same reasons as disciplinary science may be bad: they do not meet the standards of good science (whatever these are).

It may be that meeting those standards becomes more difficult as the distance from the original domain grows. But there are other kinds of situation in which meeting the standards of good science may be particularly difficult. Think of early stages of a new research field, with very uncertain speculative theories and proliferating techniques, vacillating standards and multiple interpretations of research results, and so on. If Dupré were to advise against scientific imperialism because of the risks of failure, shouldn't he also advise against launching new research avenues because they too are risky?

My overall suspicion is that Dupré's account is too much inspired by his—and many others'—doubts about evolutionary psychology and expansive economics and that it therefore fails as a general account of scientific imperialism. His reasoning is guided and shaped by his opinions and intuitions about specific scientific substance and specific cases of intellectual expansion. These do not generalize smoothly. His discussion of those special cases involve implicit assumptions that, when made explicit, cannot easily be justified as generally valid.

3. Clarke's and Walsh's Account

Steven Clarke and Adrian Walsh (2009) say they share Dupré's intuitions about the dangers of scientific imperialism, and they set out to articulate the reasons for holding those intuitions. Their focus is on normative evaluation, and they say little about what scientific imperialism is. They make progress, but as I will try to show, many problems remain.

Clarke and Walsh base their argument partly on an analogy between scientific and political imperialism. They examine the normative reasons for objecting to political imperialism and ask whether similar reasons 'explain what is in fact objectionable about the colonisations of one area of scientific inquiry by another'. They suggest that

> the normative force of the charge of imperialism in the philosophy of science is parasitic upon a general disapproval of political imperialism within our community at large. Many people believe that there is something morally wrong with political imperialism and, accordingly, if scientific disciplines are said to be imperialistic, then this is a prima facie ground for concern. (Clarke and Walsh 2009, 199)

There are two observations to be made right away. The reasoning seems to suggest that first there was the label—'imperialism'—and then emerged the disapproval in virtue of the analogy with political imperialism: a particular interdisciplinary relationship is labelled as imperialism, prompting the association with political imperialism, so better to denounce it! One might as well expect it to have been the other way around—first disapproval due to some substantive reasons for perceived failure in interdisciplinary trespassing, then the label to convey the disapproval and perhaps to explain the failure.

My second observation questions the presumed normative connotations of 'imperialism'. Clarke and Walsh suggest that 'imperialism' is a pejorative term and therefore implicitly normative (Clarke and Walsh 2009, 195, 198). There is little doubt that the term is often used with normative associations. Yet I would disagree that it is always or necessarily used as a pejorative term. It is true that many people use the expression to indicate disapproval. It is, however, also often used by others, such as many economists, to indicate not just approval, but praise and even pride associated with successful imperialistic moves (e.g. Stigler 1984, Hirschleifer 1985, Lazear 2001; see Mäki 2009). These authors consider such moves a major scientific achievement and source of merit, evidence for the scientific quality of the imperializing discipline. These proud and self-congratulatory uses of the term 'imperialism' manifest what may be called the *Kipling principle* in the context of science: the superior discipline's burden to bring scientific enlightenment to other disciplines, or at least to the study of other domains (there is a difference here that I will take up below). Many scientists subscribe to the Kipling principle, so see nothing illegitimate in scientific imperialism.

So it runs counter to these existent Kiplingian uses of 'imperialism' to define it as Clarke and Walsh do, as 'the illegitimate occupation of another's territory' (Clarke and Walsh 2009, 199). We can turn this into a definition of scientific imperialism:

> [2] Scientific imperialism is the illegitimate occupation by one discipline of another discipline's territory.

This is an improvement compared to Dupré's [1ab], in that [2] explicitly invokes the notion of discipline and gives a definition in terms of an interdisciplinary relationship. It

contains two notions that are not explicated: 'territory of a discipline' and 'occupying a territory'.

Nevertheless, let us look at how Clarke and Walsh explicate the notion of *illegitimate occupation*. They identify three possible reasons for thinking of an occupation as illegitimate: [a] it violates local autonomy; [b] it exploits local colonised populations by 'an unjust extraction of resources'; and [c] this exploitation 'unfairly prevents the exploited from realising their potential to develop' (Clarke and Walsh 2009, 200, 201).

Of these three reasons for resistance, they rightly dissolve [a] as a non-problem: population ecology adopting new statistical techniques from mathematics and physics is just fine if this improves population ecology's explanatory power. They also (partly) correctly reject [b] because '[p]hysicists do not typically go to chemistry … looking for resources to help solve problems in physics'—it is rather the other way around (but this requires qualifications due to the very notion of resource having a rather broad extension). This leaves [c] as their main target, as the major candidate for a normative basis for the opposition to scientific imperialism. They spell it out by distinguishing between two lines of argument. I will comment on them in turn.

> [c1] Colonisation by another discipline can cause a science to fail to progress in ways that it otherwise would progress. (Clarke and Walsh 2009, 201)

This is a statement about what can be called counterfactual progress. In consequence of imperialism, the imperialized discipline will not progress in a way it would progress if not imperialized. I have a number of comments on this. They all derive from the fact that the normative force of [c1] depends on many of its details.

First, there is the issue of the incidence of progress. Argument [c1] talks only about progress in the colonized discipline. It is conceivable that the imperialistic science itself makes considerable progress in virtue of colonising others. The question then is: on what grounds would it be reasonable to sacrifice this opportunity by proscribing against imperialism?

Second, there is the related issue of kinds and degrees of progress. Even if it were the case that the imperialised discipline were to fail to progress 'in ways that it otherwise would progress', it is conceivable that these foregone ways are close to worthless, at most very minor steps of improvement. The imperialised discipline failing to progress 'in ways that it otherwise would progress' is consistent with there being considerable epistemic or other advancements in that discipline and elsewhere in the whole edifice of scientific knowledge. These latter gains might easily compensate for those foregone minor losses.

It is indeed conceivable that scientific imperialism brings about overall net progress in science as a whole. This provides one way of resolving possible local tradeoffs.

Third, there is a second issue of the incidence of progress. Even if it were the case that imperialism 'can' inhibit progress in the imperialised discipline, it is also conceivable that it does just the opposite, namely it enhances progress in that discipline. The ways in which this may happen are many, of which the implementation of the Kipling principle is just one. The recipient discipline may acquire better techniques of inquiry, it may be forced to critically examine and improve the basic presuppositions of its theories, and so on.

Indeed, one should not proceed on the undisputed premise that scientific imperialism necessarily has damaging effects on the recipient disciplines. I would suggest that whether it does is a contingent and contextual matter, thus there is no one general pattern. A very important possible scenario is one in which scientific progress in some field is hampered by a local disciplinary monopoly, and that an effective way of breaking such a harmful monopoly is for another discipline to make an imperialistic intrusion. So when Clarke and Walsh consider the possibility that *due to imperialism* 'we end up accepting inferior explanations, or failing to investigate possibly superior explanatory alternatives' (Clarke and Walsh 2009, 202), I'd remind them of an alternative scenario in which, *due to no imperialism*, local disciplinary monopolies prevent scientists from exploring possibly superior alternatives, and therefore an imperialist intrusion may give a discipline a chance to break out from such shackles.

Fourth, there is an issue of disciplinary structure. Clarke and Walsh discuss as a possible consequence of scientific imperialism that 'valuable "indigenous knowledge" that might otherwise be gained, may be overlooked and valuable indigenous knowledge that has already been gained may be lost' (Clarke and Walsh 2009, 202). As a consolation, I would like to point out that in such situations, real-world interdisciplinary dynamics sometimes generate new sub-fields or schools of inquiry that store and create such threatened bodies of knowledge (it is of course also possible that this will not happen and that there will be a permanent loss of 'indigenous knowledge'). In general, what this point underlines is that disciplinary structures and boundaries are not fixed and stable, they rather adjust in ever-new ways as the circumstances change. This is an important observation that has not been sufficiently acknowledged in the accounts discussed here.

In their discussion of [c1], Clarke and Walsh imply an important distinction between 'success' and 'explanatory virtue' when they challenge the opponents to scientific imperialism to convince us that

> [c1a] there is a danger that imperialistic ideas are liable to succeed in the disciplines they attempt to colonise, despite their lack of explanatory virtue. (Clarke and Walsh 2009, 202)

Here recall that, of the two definitions by Dupré that I cited above, one was in terms of success, the other in terms of explanatory performance (as I interpreted 'illumination'). By 'success' of an idea Clarke and Walsh presumably mean things such as its wide adoption and use. I have two comments on this.

First, [c1a] is put in terms of danger and liability (and it even makes them connected in that the danger is presented as a second-order property of the first-order liability!). This makes the claim more likely to be true. But again, this truth has little normative force as mere danger or risk of a bad outcome cannot be a sufficient reason for proscribing against scientific imperialism. Risk taking is a mark of good science.

Second, Clarke and Walsh give an explanation for why the danger suggested by [c1a] might materialise. It is not because members of the potentially colonised disciplines are 'naive dupes who are liable to fall for the illusory charms of inferior explanations' but rather because 'intelligent researchers' adopt those explanations since they 'have proved to be fruitful elsewhere' (Clarke and Walsh 2009, 202). In response to this, I would say I find any sole focus on these sorts of factors a little too individualistic and too epistemic. Instead, I would suggest a more comprehensive array of possible causes of the adoption of inferior explanations by pointing to institutional matters such as intellectual fashion, disciplinary status, competition for resources, etc.

Let us then consider their second way of justifying the opposition to scientific imperialism: 'colonisation by another discipline may lead scientists to fail to appreciate values that are relevant to their discipline' (Clarke and Walsh 2009, 201–202). This formulation gives the impression that actually existing disciplines and their characteristic values are among the ultimate sacred givens, so whatever threatens them is thereby suspect. But what Clarke and Walsh apparently mean after all is a broader set of values that have general cultural significance and that are somehow expressed by an endangered discipline. So a defensible reformulation might go:

> [c2] Colonisation by another discipline may lead scientists in the colonised discipline to fail to appreciate human values of general cultural significance.

As an example, Clarke and Walsh discuss the traditional concern about economics imperialism. The concern is that the spread of methods such as cost–benefit analysis and concepts such as the market to the human sciences will 'undermine traditional (and valued) ways of relating to one another' (Clarke and Walsh 2009, 203–204). They say

this is more plausible in defending the human sciences against the imperialistic incursions of economics and evolutionary psychology than against imperialism between two or more natural sciences.

My comment here is similar to what I said above about Dupré's account. The argument is closely linked to specific disciplines and their specific current contents and relations, so does not say much of general validity about scientific imperialism. Indeed, as a generalisation (without 'may'), [c2] fails. Clarke and Walsh consider the possibility of failing to appreciate the full range of human values in consequence of scientific imperialism (by economics and evolutionary psychology). I can think of situations that are the exact opposite. Indeed, it is quite conceivable that a discipline based on a full appreciation of human values invades one that is not so based, and that this results in a fuller appreciation of such values in the recipient discipline. Think of, say, Nazi science being so invaded (with the help of changes in larger circumstances), or what some consider 'inhuman' economics being invaded by various humanistic disciplines. I would suggest such cases should not be excluded from the scope of scientific imperialism by definition.

Let me summarize my criticisms of Clarke's and Walsh's account by responding to their own summary of their two main arguments:

> [i] If instances of scientific imperialism were to lead to the adoption of explanations that are inferior to those that would have otherwise been adopted, then these should be resisted. (Clarke and Walsh 2009, 205)

Response: Scientific imperialism is neither sufficient nor necessary for such poor explanations. It does not have to lead to such explanations, and there are other developments that can lead to them. Any developments in science that are found to lead to such inferior explanations should be resisted. Importantly, finding out about such an inadvisable development should be a matter of empirical discovery, not of a priori judgement.

> [ii] In the human sciences, scientific imperialism raises an additional concern, which is that important human values could fail to be expressed, and we might become the sorts of people that, on reflection, we would not wish to have become. (Clarke and Walsh 2009, 205)

Response: Again, this concern should not be restricted to scientific imperialism. Imperialism does not necessarily have such consequences, and the suppression of important human values may as well take place within some human science disciplines

without any imperialistic intrusions. Once we discover such developments, wherever, we should resist them because of their unwanted consequences, not because they may be due to scientific imperialism.

4. My Account

Scientific disciplines are institutional structures that have sometimes been considered in analogy to nations and countries, which makes it tempting to consider scientific imperialism as an interdisciplinary relationship in analogy to imperialism between countries. But it is well known that the latter notion is not a simple and easy one. No wonder then that the challenge of scientific imperialism to the philosophy of science is rather demanding for several reasons. It is a complex and fluid phenomenon with both institutional and epistemic aspects and a variety of types and dimensions – and hard-to-classify boundary cases. This is why no single compact definition can be given and why its empirical identification and normative evaluation tend to be so difficult. In previous work, I have tried to disentangle some of these types and dimensions as well as to outline some normative principles for assessing them (see Mäki 2002a, 2002b, 2009; Mäki and Marchionni 2011).

4.1. Kinds and Aspects

One relevant division is between issues of scope, style, and standing. These highlight different aspects of the interdisciplinary relations at stake.

> *Imperialism of scope.* An expansionist discipline seeks to explain phenomena that belong to the perceived domain of another discipline. This is the pursuit of explanatory unification that is disrespectful for disciplinary boundaries.
>
> *Imperialism of style.* The styles and strategies of research, such as the techniques and standards of inquiry and communication, characteristic of one discipline, are transferred to, or imposed on, other disciplines.
>
> *Imperialism of standing.* The academic and non-academic prestige, power, and resources as well as the acknowledged technological and political relevance of one discipline increase at the expense of those of another.

It is useful to start with issues of scope. This is also Dupré's point of departure. It is important to see what is and what is not imperialism in regard to scope. Mere scientific

expansionism is simply a matter of applying a scientific idea developed within a discipline to new domains of phenomena. Explanatory unification of the old and new domains may result, but no interdisciplinary issues are at stake since the explanandum phenomena are not defined in disciplinary terms. Note that Dupré's definition [1ab] literally taken only deals with non-imperialist expansionism in this sense.

One may set out to oppose expansionism directly by simply questioning the possibility or desirability of unification in general, perhaps on general metaphysical grounds. Or one may resist particular instances of expansionism for local reasons of lack of fit of the theory with the new domain. Much of what Dupré writes seems to fall into these categories.

Expansionism turns into a form of *imperialism* once the new domains are defined in disciplinary terms, suggesting that they 'belong to' the 'territory' that is already 'occupied' by another discipline. 'Belonging' and 'occupying' are not easy concepts to analyze in this context, but we can take them to include situations such as those in which the other discipline's 'identity' is being partly constituted by having those phenomena in its explanatory purview, or in which it has made regular attempts to explain those phenomena, or at least has programmatically defined its scope so as to include them.

The weakest and most innocent version of imperialism of scope is one in which the expansionist discipline simply sets out to explain phenomena in domains belonging to other disciplines while ignoring these disciplines themselves. This is *domain-only imperialism* that directly addresses new phenomena and bypasses disciplines that claim those phenomena as 'theirs'. There is no intrusion into other disciplinary cultures and practices. Much of perceived scientific imperialism is of this kind.

Because there is no direct interdisciplinary encounter in the domain-only case, it is not always clear how the explanations provided by the two disciplines are related. Supposing the discipline previously claiming the domain has actually developed explanations of phenomena in the domain, the explanations offered by the imperialistic discipline of the same domain can be *rival or complementary* in relation to them (cf. Mäki 2002). Naturally, rivalry in explanations pose a more serious challenge to the other discipline, so we can say this gives a stronger form of domain-only imperialism than the complementary explanations case.

Disciplinary imperialism is more far-reaching and intrusive than the domain-only variety in that other disciplines – and not just 'their' domains - are targeted. It features either imperialism of *style* or that of *standing*, or both. Disciplines are institutional structures that involve conventions and convictions, standards and strategies, ideals and identities, principles and practices, styles and statuses, rules and resources, ordinances and organizations. Disciplinary imperialism challenges the disciplinary institutions of the imperialized disciplines. Challenge can take many forms, from careful and respectful

argument to arrogant dismissal and divestment of academic resources.

Such various kinds of imperialism can also be *variously related to one another*. For example, issues of style and scope do not have to be closely linked. Domain-only imperialism may proceed—at least initially—without disciplinary imperialism. Likewise, disciplinary imperialism of style can proceed without imperialism of scope: methods and strategies characteristic of one discipline may travel to another discipline without an attempt to explain phenomena in the domain of the latter in terms of theories in the former. On the other hand, there may be mutually reinforcing connections. The rivalry version of domain-only imperialism may in due time lead to disciplinary imperialism. The likelihood of success of an imperialism of style by an intruding discipline may be fortified by a high standing of that discipline. And so on.

Scientific imperialism can be driven *externally or internally* (to the recipient discipline), that is, it can be driven by the imperializers or by the imperialized, or by both. The imperializers can be motivated by a strong disciplinary confidence in the power and superiority of their own theories and research styles, perhaps by a feeling of a justified Kipling principle. The imperialized may be willing to adopt ideas from elsewhere because they perceive their own discipline to be deficient in one way or another, such as lacking powerful theories and methods, or unity. For example, much of the impact of economics on political science and biology seems to be based on such internal dissatisfactions within the latter disciplines.

One final observation I want to make here is that a too holistic account of scientific imperialism can often be misleading. Disciplines—both at the giving and receiving ends—typically are not fully uniform and unified wholes but rather more or less—in some cases more, in some others less—fragmented and changing structures with various components that are rigid or flexible in different degrees (cf. Davis 2012). We can try to express this in various ways, one of which is to draw a rough distinction, or perhaps rather a continuum, between imperialism and colonialism (note that Clarke and Walsh talk about ‘colonisation’ but do not draw the distinction). While imperialism would be a matter of wholesale conquest of another discipline or its domain, *colonialism* would be a matter of retail conquest, one of establishing limited intellectual ‘colonies’ into the structure of the recipient discipline. Most of what is considered scientific imperialism is colonialism in this sense. For example, one might say that neuroscience has colonized small parts of economics, and economics has colonized parts of neuroscience. It is clear that the dimension suggested here complicates the task of descriptive identification—how to draw a line between imperialism and colonialism—as well as the task of normative evaluation—wholesale imperialism easily appears more suspect than retail colonialism, but the reasons are not easy to spell out.

4.2. Constraints and Chances of Progress

Defining the concept of scientific imperialism and identifying its actual instances are not easy. This does not make its normative evaluation any easier.

Again, let us begin with imperialism of scope. This gives us an epistemic notion of scientific progress, one of advancement in knowledge, including explanatory knowledge about the world: growth of explanatory unification. Might scientific imperialism on some conditions help make epistemic progress in this sense? I approach this question in terms of *constraints on the pursuit of explanatory unification across disciplinary boundaries*.

The first constraint is ontological. The desired accomplishment is *ontological unification* of apparently diverse kinds of phenomena. The pursuit of unification in its ontological mode is a legitimate process of *discovery of the extent to which there is unity in the world itself*: the extent to which parts of the world are made of similar components, governed by similar laws, or generated by similar causal mechanisms, and so on. The only way to find out about the limits to this ontic unity is to try to unify as far as possible, regardless of whether disciplinary boundaries are being crossed. Disciplinary boundaries appear just as arbitrary institutional artefacts that should not impose any obstacles to this endeavour. So the first constraint on scientific imperialism is that it should be based on the pursuit of ontological unification (in contrast to *mere derivational unification*, that of deriving as many explanandum sentences as possible from a maximally parsimonious set of explanans sentences or a simple explanatory scheme without any ontological commitments; see Mäki 1990; for further issues, see Kuorikoski and Lehtinen 2010).

The second constraint is *epistemological*. No assurance of achieved ontological unification can ever be perfect, and in many cases it falls short of perfection by a vast margin. Often a great deal of epistemic caution is advisable when accepting and rejecting theories and explanations both on the home grounds of a discipline and in far away territories. Especially in the social and human sciences, radical uncertainties derive from situations of uncontrollable underdetermination (which can be more easily hidden by skilful manipulations of auxiliary assumptions if mere derivational unification were pursued). Any imperialistic claims about the cross-disciplinary unity of phenomena must be accompanied by explicitly stated careful provisos rather than hidden uncertainties.

The third constraint is *axiological*. This is where non-epistemic values come in. Achievements and failures in unification must be weighed in terms of the importance or significance of the unified phenomena. Importance is relative to human interests and values of various kinds -- from practical to moral and cultural – as well as to specific community and context. Theories that unify insignificant phenomena while (or in virtue of) ignoring or marginalizing significant ones are much less supportable than those that

unify significant phenomena at the expense of less significant ones. The concern about important human values failing to be expressed and even being suppressed in consequence of scientific imperialism (as in Clarke's and Walsh's account) is part of the motivation for putting forth the axiological constraint.

The fourth constraint is *institutional*. The pursuit of cross-disciplinary unification should proceed under the guidance of the rules and regulations of appropriately virtuous scientific practice. The optimal institutions of good science should advice for respectful humility and against dismissive hegemonic arrogance in the relations between disciplines. They would support critical and open conversational culture as well as sufficient degrees of diversity and tolerance, while proscribing against closed dogmatism and uniform intellectual monopolies protected by non-argumentative means of exclusion. Imperialism that proceeds by engaging in open debate and by spelling out and defending its presuppositional posits is more acceptable than imperialism that succeeds merely or mostly by relying on the academic and non-academic standing of the imperialistic discipline.

Within an appropriate institutional framework, there is little reason to worry about imperialistic trespassing. Scientists can be encouraged to take epistemic risks that are involved in attempted interdisciplinary expansion or invasion, as this would be a matter of ordinary trial and error in the pursuit of epistemic progress. In the case of error—failure to ontologically unify with strong epistemic and axiological warrants—imperialists would retreat to their home grounds. On the other hand, success that meets the constraints constitutes progress and should not be objected, since important discoveries about the extent of the unity of the world can be made. Disciplinary imperialism of style in conformity with the above constraints can lead to fruitful debates between the participant disciplines and their subfields, resulting in better methods, more rigorous standards etc. in the recipient discipline—and perhaps the discovery of flaws and heretofore ignored opportunities on the home grounds of the imperialising discipline.

4.3. Back to Issues of Definition and Identification

The framework outlined above helps to see more clearly the difficulty of the issues of definition and identification. First, there are two alternative lines of definitional strategy. I have suggested a way of distinguishing between good and bad scientific imperialism in terms of normative constraints, but imperialism itself is defined neutrally in terms of scope, style and standing in interdisciplinary relations. Instances of imperialism are rendered acceptable and even desirable if they meet the above set of four constraints. An obvious alternative way of defining scientific imperialism is also within the framework, but it would restrict the concept to what I've presented as bad versions. So on this

alternative definition, only attempts at interdisciplinary trespassing that violate the ontological, epistemological, axiological and/or institutional constraints would qualify as scientific imperialism. On this normative definition, scientific imperialism is always to be resisted.

Second, what does it take to empirically identify instances of scientific imperialism—or good and bad versions of it—on these definitions? The difficulty of answering this question derives from the difficulty of judging whether the above four constraints are actually met or violated by instances of interdisciplinary trespassing. Meeting the constraints cannot be an on–off matter, one rather should judge whether the constraints are met in a sufficiently close proximity to the ideal perfection, or else violated in a too serious manner. Any actual situation will violate the ideals to some extent, so the challenge is to judge whether the violations are small enough to be negligible. This is no easy task, and many such judgements will be contestable. As should be clear, the above two definitional solutions must face this challenge, and neither of them is superior to its alternative in being able to escape the problem of estimating actual degrees of constraint violation.

Acknowledgements

An earlier version was presented at the University of Vienna. I thank the participants of the seminar for many inspiring comments. Work on this paper has been sponsored by the Academy of Finland Centre of Excellence in the Philosophy of the Social Sciences.

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